

WSDOT Noise Wall Cost Effective/ Aesthetics Task Force Final Report

March 11, 2008



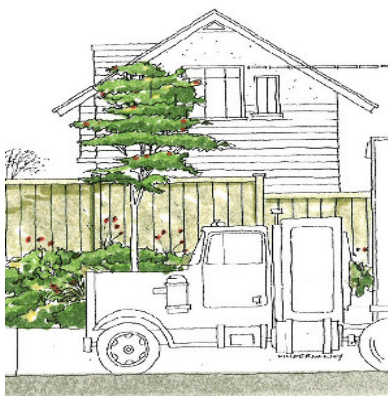
STANDARD PLAN ADDITIONS, REVISIONS,
AND SURFACE TREATMENTS



NEW PRODUCTS LIST



INTERNATIONAL PRACTICE



ROADSIDE TREATMENT AND HIGHWAY
CORRIDOR CONTINUITY

2007 LEGISLATIVE PROVISIO

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EXECUTIVE SUMMARY

The Noise Wall Cost Effective/Aesthetics Task Force makes these recommendations to current practices in design, construction, and maintenance of noise walls to decrease costs:

- Reinstate the use of Standard Plan D-2o where pilasters are structural and visible elements.
- Provide a new Standard Plan D-2p where pilasters are structural yet not highly visible elements as viewed from the corridor.
- Refine Standard Plan D-2.78-00 Timber Panel on Trench Footing. The design may prove effective in uses dictated by the 2007 Legislative Noise Proviso.
- For Standard Plan walls detail rustication grooves and combinations of smooth finishes in the surface treatment that correspond to typical dimensions of industry standard concrete form liners thereby allowing the contractors to use the less expensive plastic formliner materials.
- In order to simplify designs and avoid expensive specials finishes, expand the ‘pallet’ of Qualified Products List standard formliner concrete finishes and produce a ‘catalog’ available on the WSDOT web site.
- Produce contract designs with those noise walls *approved with limitations from* the New Products List. These include Allan Block Fence, Stonehenge Concrete Walls, Ultrascreen Sight and Sound Barriers, and Tuff Fence. Document performance of new products in Lessons Learned database, including cost of material, installation, and maintenance.
- Coordinate with Landscape Design disciplines to emphasize the ‘continuum of green-to-gray’ principles that decrease the requirement for concrete surface treatments and allow for alternative walls from the new products list.

Quantified cost savings resulting from these recommendations are beyond the scope of this report. Savings should be monitored as the recommendations are implemented and cost data collected.

INTRODUCTION

The use of noise walls has increased beyond typical project requirements with legislation such as the 2007 Noise Proviso and the efforts of community action groups. At the same time construction costs have increased. In an effort to decrease costs, the Noise Wall Cost Effective/Aesthetics Task Force was formed in 2007 to make recommendations to current practice in design, construction, and maintenance of noise walls.

A multidisciplinary group of WSDOT experts in noise abatement, materials, architecture, landscape architecture, maintenance, and design was formed. The task force divided into subcommittees to take advantage of skilled technical expertise. The whole group convened regularly to ensure continuity.

The recommendations are within WSDOT Standard Plans, the New Products List, international developments, and coordination with landscape and roadside restoration. Additionally the requirements of 2007 Noise Proviso were included. The study focused on decreasing costs while maintaining or improving aesthetics.

COMMUNICATION/IMPLEMENTATION OF FINDINGS

In addition to this report Task Force members will present findings at various WSDOT venues. Preliminary findings have already been presented at SWR and NWR Design/Construction Conferences, the AGC/WSDOT Joint Structures Committee.

The report and recommendations will be distributed through WSDOT Project Development engineers and WSDOT websites. The Bridge and Structures Architect will take the lead in initiating all recommendations.

Early implementation has occurred during the preliminary findings phase for new Standard Plan production and QPL formliner updates.

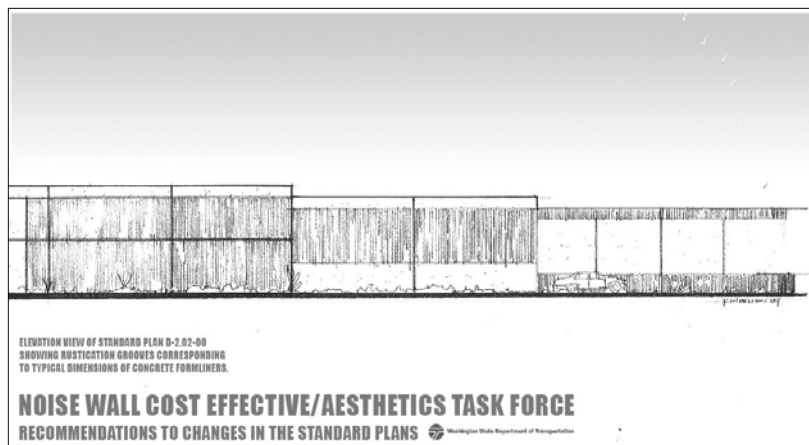
TASK FORCE RECOMMENDATIONS

Modifications to the Noise Wall Standard Plans

Background

In the 1980's WSDOT discontinued the use of precast pilaster noise walls based on aesthetics. At the time designer and architects felt that taller walls produced awkward proportions with the typical 12 ft pilaster spacing. Although technically correct, the potential cost benefits now outweigh the strict visual requirements. Additionally the I-405 Context Sensitive Solutions process resulted in designs that favor the 'pilaster look'. Note that the 'awkward' proportions may be mitigated by visually "breaking up" the wall with concrete textures, or obscuring with landscape plantings. Also note that the pilasters may be constructed flush with the front face of the wall and textured to blend with existing corridor designs.

Savings may be achieved through the use of combined smooth and textured concrete with rustication grooves. The less expensive plastic (ABS and PVC) formliners come in typical ten-foot lengths; therefore less expensive architectural treatments can be achieved by using these units in designs. The figure shows several possible designs employing patterned concrete, rustication grooves, and smooth concrete finishes in increments of ten-foot units. The contractors could use ABS or PVC formliners for these designs, rather than the more expensive elastomeric materials.



Recommendations

STANDARD PLAN D-20

Reinstate the use of Standard Plan D-20 where pilasters are structural and visual elements. There is evidence from the contracting community that D-20 will lead to cost savings due to ease of constructability and shortened construction time.

STANDARD PLAN D-2P

Introduce a new standard plan based on D-20 where pilasters are structural elements, yet not highly visible. The pilasters will lead to the same efficiencies as D-20 yet will blend with those areas without pilasters.

STANDARD PLANS D-2.02 TO D-2.60

For typical construction with form liners: detail rustication grooves along horizontal splices based on typical dimensions of industry standard concrete formliners. Alternately combine sections of smooth-finished concrete with other, textured surface treatments. The grooves and combination of textures will allow the contractors to use less expensive ABC or PVC materials. Prior to the findings of this Task Force, horizontal joints were only allowed when using the more expensive elastomeric form liners because the joints would not be apparent.

STANDARD PLAN D-2.78

Redefine the materials of Standard Plan D-2.78-00 Timber Panel on Trench Footing to include synthetic or composite materials with longer life-spans than untreated wood. The panel designs will prove effective in uses dictated by the 2007 Legislative Noise Proviso.

Finally the materials of the timber panel standard plan should be revised. Newer synthetics may be more cost effective and longer lasting. And since the 2007 Noise Proviso will require neighborhood scale fencelike walls, the standard plan may come into use again.

Modifications to the New Products List Procedures

Background

In 2000, WSDOT established a process for reviewing new materials for various construction needs throughout the agency. This “New Products List” currently includes 15 materials proposed for construction of noise walls. The review system consists of evaluations by WSDOT Bridge and Structures, Design, Materials, Acoustics, and Maintenance divisions. Most of the information required for this review is readily available from the vendor, on line, or from agencies that have used the product before. However, critical maintenance questions are not answered as readily. Replacement of damaged panels, graffiti removal, cleaning, and availability of parts are critical issues which must be addressed so that a wall system can be evaluated against current materials and practices. Because WSDOT currently uses primarily concrete noise walls, replacement costs are known and can be budgeted for. Other maintenance operations are also easier to budget for with a single type of noise wall material. However, the potential cost savings from with using other noise wall materials has urged the Task Force to consider testing some of these new materials in the field.



Recommendations

After reviewing the current New Products procedures and the contents of the list relating to noise walls, we recommend that WSDOT:

1. Develop a standard procedure for selecting products from the "New Products" list for "pilot projects."
2. Document each new noise wall product implemented in a "pilot project" in the current "Lessons Learned" database

Before WSDOT embarks on approval of any new systems there needs to be an established process which includes the Maintenance concerns. We recommend that all new noise wall materials be approved by the Regional Maintenance Engineer prior to inclusion into any contract plan.

Four of the 15 noise wall products on the New Products List were selected for "pilot projects," based on the approval of the initial review groups; the product's potential to blend with the corridor aesthetics; availability of the product; and potential for cost savings based on ease of installation. They are listed in the table below. Photos on the following page illustrate these materials.

Product	Product Number	Web Site / Comments
Allan Block Fence	2004-08	http://allanblock.com Approved – masonry-type blocks in various colors. If you can install these without removing as many trees, then you save cost.
Stonehenge Concrete Walls	2004-47	http://www.stonehengewest.com Approved – limited to 8' tall walls. Some aesthetic finishes such as brick, stone, and wood plank patterns available.
Ultrascreen Sight and Sound Barrier	2007-20	http://www.bigskyrcontrol.com/ ultrascreen Approved – versatile material that can have aesthetic surface treatments. It can also be designed around a curve.
Tuff Fence	*	http://www.tufbarrier.com/ company.html Approved – if the slats are installed in a vertical pattern like fence planks and not horizontal like house siding. Various colors available.

Discussion

When construction projects are selected to participate as the “pilot projects” up to four of the noise wall material options will be listed on the contract, depending on their applicability within the project context and character. This allows the contractor to choose based on market considerations. This would provide valuable information to WSDOT regarding the cost of the materials and construction, along with the experience of using the material. Below is the list of the noise wall material candidates that were selected for implementation on a “pilot project”. The "pilot project" site would be monitored, documenting the variables of maintenance (cost and issues encountered), cleaning, and issues regarding replacement parts. Once the desired monitoring period has been completed, the contractor, maintenance, and WSDOT project managers should meet. They should review all aspects of the “pilot project” and compile a final report. This report should include their recommendations as to acceptance or rejection of the product, along with any conditions under which the product is considered most appropriate. The report will be submitted to the Lessons Learned database, and forwarded to the New Products Coordinator. The coordinator would then notify the vendor and other responsible individuals as to WSDOT’s final decision.



Allan Block (left top)
Ultrascreen (right top)
Tuff Fence (middle) and
Stonehenge (bottom)



Integration of International practice

Background

This task force subcommittee looked at international noise barrier practices to find out if any of those practices could be adopted by WSDOT in a cost effective manner.

Though a fairly intensive internet search was conducted, there was little information that could be found on costs and installation practices. The internet provided some nice pictures of different systems used in Europe, Australia, and New Zealand. Most of the noise wall systems were of known high cost noise barrier systems. Some of the other systems would not work in Washington state do to their "natural product" make up like the use of sticks and branches woven into mats.

It is unsure if further research into international practices would acquire any additional useful information that could be adopted by WSDOT.

Recommendations

Due to the low likelihood of implementation, the Task Force recommends no further research into international practice at this time.



Examples of transparent and vinyl noise walls in Europe and Australia.



Roadside Treatment and Highway Corridor Continuity

Recommendations

As new noise abatement products and alternative solutions are considered for a project within a highway corridor, it is important to evaluate the context of the proposed solution and the affect on the visual experience for those that travel through the corridor, as well as those that look toward the highway.

Noise abatement must be done in a way that preserves or enhances and does not negatively impact the visual quality of the environment. Introduction of human-built elements, such as walls, can have an affect on the visual quality by altering the natural environment and can create visual conflict and discordance. Walls can block or interrupt desirable views. When human-built elements are introduced, the goal is to maintain visual quality and to avoid the introduction of inconsistent or conflicting elements concerning line, form, color, and texture. It is important to evaluate how noise wall types, textures and colors blend to create a continuous and harmonious visual experience.

In some locations where the width of right-of-way will allow, an earth berm can be used to provide noise abatement. Earth berm solutions must be planted to restore and blend the feature into the roadside. Existing desirable vegetation must be evaluated when considering this solution, to preserve and minimize the disturbance. The form of the berm should be natural to blend with the surrounding landscape.



This drawing shows the integration of noise walls and landscape planting.

The location of a noise wall within the roadside and the proximity to the viewers can reduce or increase the affect on visual quality. Vegetation can play a key role to mitigate and soften the visual affect of a noise wall. Restoration or introduction of roadside vegetation should always be included with noise abatement. Every effort should be made to retain existing desirable vegetation that provides buffering and separation of land uses. The closer walls are located to the highway, the less ability there is for vegetation to screen/buffer and blend walls into the corridor. In locations where screening and buffering is not possible, it is critical that walls are made to be visually compatible with other elements in the corridor through appropriate use of wall type, texture, and color.

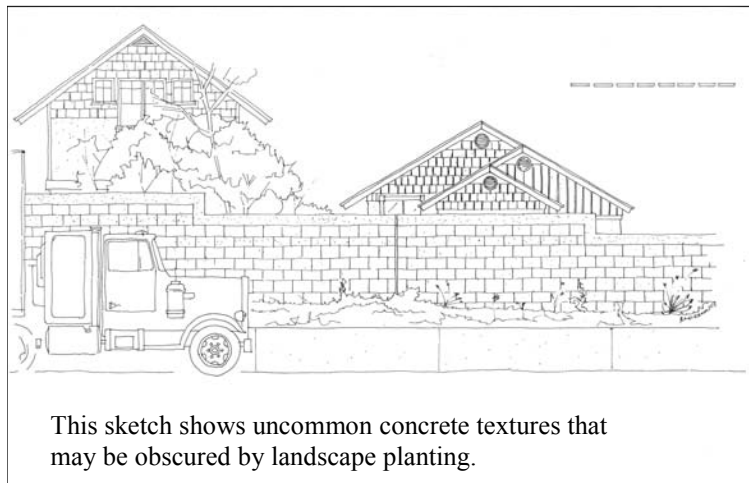
In determining an appropriate solution for noise abatement, it is important to include the State Bridge Architect and the Region or State Landscape Architect on the interdisciplinary design team following the processes outlined in the Design and Roadside Manuals. The State Bridge Architect, in concert with the Region or State Landscape Architect, has the approval authority for the type and visual treatment of noise walls.

Highway Corridor Continuity

As projects are planned within an existing highway corridor or when a new section of highway is constructed, design of the visible elements is developed to provide visual uniformity and harmony with the existing visual environment. The types, textures, and colors of elements, such as walls, lighting, signing, structures, and planting are to be designed to blend with existing features and other new elements. This, in turn, creates a continuous visual experience as one travels through a highway corridor. The design should also consider the community context when blending elements into neighboring environments. A transition between different visual styles is designed to create harmony and continuity for the overall corridor visual experience.

When considering the introduction of a new type of noise wall, the designer should work to blend the texture and color. If a wall type visually contrasts with existing and other proposed elements, it should only be used in locations where it can be permanently screened by vegetation, i.e. away from the roadway edge or blocked by land forms. If the location is visually exposed to highway users, wall type, texture, and color must be selected that will integrate the new features with existing features. Color should

remain constant through the corridor. Texture should also have a common theme throughout a corridor. In some cases there may be opportunities to use the texture in a different way to provide variety and a sense of place (for example; smooth inset designs within the texture, or vertical bands of the corridor texture alternating with another texture, etc.). This concept could also be used where it is necessary to transition from one texture to another.



In locations where community concerns for noise have been raised and standard noise wall criterion does not qualify, planting may provide some relief. The Legislative noise proviso has outlined considerations for these locations. Planting should always be considered as a first solution in these cases, following the “continuum of green to gray” principles. The built alternative treatments that have been identified for these circumstances can only be located where they will not be visible and where they can be screened by vegetation.

Roadside Classification Plan

The Roadside Classification Plan sets the policy for the roadside within Washington State. It focuses on designing, constructing, and maintaining a sustainable roadside that blends with the natural and human environment, provides corridor continuity, and can be managed at the lowest life-cycle cost. The emphasis is on the preservation of existing desirable vegetation and the use of native plant species to restore the roadside. All roadsides within the state are classified based on the overall visual character of landscape.

Roadside Treatment Guidelines are outlined for each classification. Any planting that is done in a project must be consistent with the classification and the outlined treatment levels.

Roadside Treatment

Planting is used to mitigate the affect of introducing a noise wall or other noise abatement feature into the roadside. Trees, shrubs, groundcover, grasses, and vines, as determined appropriate, should be incorporated to soften, buffer, and break up the horizontal line of walls. New planting must be sustainable over time and maintenance requirements must be considered. Design standards (clear zone and sight distance requirements) and the width of the right of way will guide planting type and location. It is important to consult the Region or State Landscape Architect to develop roadside vegetation treatment. Their involvement should begin with determination of the type of abatement feature to be used and the design of alignment and location of the feature. This will assure that other roadside functions are incorporated into the design and that appropriate mitigation is feasible.

2007 Legislation: Noise Proviso

Background

In 2007 state legislators directed WSDOT to provide “Community-scale noise alternatives that transportation projects may consider where noise impacts do not meet requirements for noise abatement, but opportunities for enhancements exist within the project scope.” Limitations of scope will require project engineers to search for low cost noise walls.

The recommendations of the task force will be a help to designers asked to do ‘more-with-less’. The following excerpts from the proviso will instruct designers and are included in this report to bring attention to the ‘overlap’ of efforts between the proviso and the task force.

“The WSDOT new products group led by the headquarters Materials group in Tumwater, Washington spearheads the evaluation and acceptance of new materials for use along the roadside. Product approval includes input from many key stakeholders in WSDOT, including maintenance, safety, structures, acoustics, architecture, and landscape architecture. For a list of approved or provisionally approved noise related products, please contact Shawn Gilbertson at 206-440-4543.”

“To continue with the “continuum of green to gray” identified at the start of this document, if a design team wishes to include a solid fence or structure of some kind into the project in an effort to shield residents or slightly improve the noise environment, the design team shall also link placement of the structure with an appropriate vegetative planting plan to shield the structure with vegetation.”

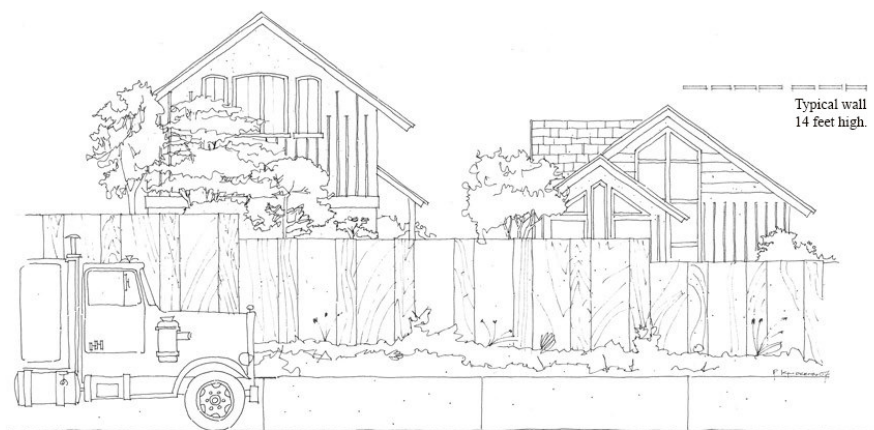
The Noise Proviso (Appendix D) outlines various concepts to include when pairing shielding structures with vegetation.

Recommendations

Designers should become familiar with the directions of the Proviso and integrate the recommendations of the Task Force.

The sketch demonstrates the visual interaction between neighborhood scale noise walls as fences and landscape elements.

Typical noise walls may be 14 ft high, shown by the dashed line.



TASK FORCE MEMBERS AND TECHNICAL EXPERT RESOURCES

Paul Kinderman	State Bridge and Structures Architect, Facilitator
John Livingston	Headquarters Materials Laboratory, New Products List
Mia Waters	Northwest Region Noise and Air Quality Manager
Sally Anderson	Interim State Landscape Architect
Dave Peterson	Northwest Region Principle Landscape Architect
Ryan Collins	Headquarters Bridge and Structures Noise Wall Specialist
Scott Sargent	Headquarters Bridge and Structures Specifications and Estimate Engineer
Anna St. Martin	Lead Designer SR 520 Project Office
Mike Katzer	Northwest Region Maintenance

RESOURCES

WSDOT DESIGN MANUAL	(M 22-01)
WSDOT BRIDGE DESIGN MANUAL	(M 23-50)
WSDOT ROADSIDE CLASSIFICATION PLAN	(M 25-31)
WSDOT ROADSIDE MANUAL	(M 25-30)
2007 LEGISLATIVE NOISE PROVISIO	